

## USE OF ALTERNATIVE ENERGY IN THE STATE OF MEXICO

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### ABSTRACT

Alternative Energy consumption is one of the great measures of progress and welfare of society. Since the sources of fossil and nuclear energy are finite it is inevitable that at some point the demand can not be supplied, unless it is to discover and develop new methods for energy, these would be the alternative energy. That said it is also that abuse of current conventional energy today such as oil, coal combustion among other aggravating carry it problems such as pollution, increased greenhouse gases and drilling layer ozone.

In the end, it focuses on describing the different types of alternative energy generation to reduce conventional energy consumption, to reduce the demand for energy production, taking the State of Mexico as a point of studying different areas such as topography, climate etc. which have impact on the project in order to improve the quality of the environment and be updated on the use of technologies.

The conclusions take into account citizen participation in three municipalities of the region in which it is observed that the population does not have enough information about the subject, but are interested in knowing more about the research, making it more important to create an education environmental, the result was obtained thanks to the graphical query Census of Population and Housing.

This project was conducted to provide an overview of how is electricity and households that do not have service, it is a guide to information on the different types of energy and raises the proposals to be made in different areas of study.

This type of energy at present not look much but they are becoming a focus of study and implementation by countries and to improve the quality of life of its population and aiming at the reduction of pollution caused by generating conventional energy. As well as promoting research not only for the State of Mexico, but for any region of the world.

Keywords: sustainable, quality of life, energy efficiency

## **1.- Justification**

This project was done with the intention of being able to give importance and care that have these energies to focus on this issue as already mentioned is to introduce new methods of energy production in order to reduce overproduction of conventional energy, and same as disclosing that the daily energy we use until today come from nature, meaning that energy demand increases every day and make an over production of energy.

It is important to note that alternative energies, although renewable, are also finite, and like any other natural resource will have a fully utilized. Therefore, even if we can make the transition to these new energies smoothly and gradually.

## **2. General purpose**

Describe the different types of alternative energy generation potential to reduce conventional energy consumption, in order to provide services to underserved communities in the State of Mexico that do not have the service, site conditions that lie.

### **2.1.- Specific objectives**

- Introduce forms of energy transformation by explaining the operation and efficiency of each of these.
- Reduce the generation of greenhouse gases that harm our planet by implementing the use of alternative energies.
- Propose placement of alternative energy generators in regions of the State of Mexico that occupy more.

## **3.- Problem**

From one point of view, there is a trend globally by a concern for the care of the environment, in which the use of alternative energy arises as a way to help reduce global warming through proposals using alternative energy equipment.

Thus it is necessary to investigate the possibility of replacing the everyday ways of using energy that you bring a monetary savings as a personal benefit and environmental benefit as a general benefit. With that recognize the advantages of working with an alternative and clean energy.

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## **4.- Formulation of the problem.**

Why people do not use this type of energy? This is one of the points which we have to base, it's because people do not use these energies, knowing that these are not new, have emerged years ago but due to misinformation environmental education is not carried. One of the reasons why people hesitate to use these energies is by beliefs that did not work, it's just a bad investment, not giving power supply to supply. The most important and so you should realize is that "the practice of using alternative energy contributes to protecting the environment, an issue often heard in these times we live in." [7]

## **5.- Types of alternative energy and efficiency**

### **5.1.- Alternative energy**

"Energy sources are not connected to the mains, potential energies present in the form nature, and almost unlimited use" [1]

That said this type of energy are present all around us and can be transformed into electricity as well as heat, raised as an alternative to traditional classical which are currently in high demand and production generates enormous amount of pollution released into the environment.

#### **5.1.1.- Solar energy**

The idea of harnessing solar energy is not new, it was not until late 1970 that the technology had to make this possible. The basic process is simple. Solar panels concentrate sunlight that falls on them and convert it into energy. This is accomplished in various ways and depends on the objective; either electricity to a region or hot water for a pool. [2]

#### **5.1.2.- Hydropower**

Hydropower uses the energy of falling water to turn turbines and generate electricity. The energy generated in this way depends on control of a watercourse such as a river, often with a dam.

#### **5.1.3.- Biomass fuel**

"Biomass" define almost any vegetable waste, wood waste, agricultural waste and landfill, as well as certain crops used as fuel. [3]

These wastes come from industries such as logging, construction industry, paper; agricultural wastes come from the cultivation of land; and even solid waste landfills come from municipal waste.

#### **5.1.4.- Wind energy**

Small windmills were common around the world until replaced by steam engines and later by electricity.

Interest in large wind turbines increased since the oil crisis of 1970. By 1980, wind power mills, rows of turbines began to be seen in rural areas worldwide. [1]

#### **5.1.5.- Geothermal**

Geothermal energy takes natural sources, such as hot springs and steam jets, and uses them to produce electricity or supply hot water to a region. [3]

Geothermal power plants send the steam that reaches the surface of the Earth through turbines. The turbines rotate and drive generators that produce electricity. Geothermal energy can be used directly for heating homes.

#### **5.1.6.- Thermal energy**

"Solar thermal energy or thermal energy involves harnessing the sun's radiation to produce heat. The means to achieve this temperature is input through solar collectors or collectors consisting of a surface that is exposed to sunlight absorbs radiation and transforming it into heat which is transported through fluid "[4]

Thermal energy is the form of energy involved in the heating phenomena. When two bodies at different temperatures are contacted, the energy communicates hot to cold; the type of energy that is transferred from one body to another as a result of a temperature difference.

## 6.- Communities of Mexico state that does not have the service of electricity.

From October 2009, CFE is responsible for providing electric service throughout the country. It consistently is the company responsible for supplying electric power in our state, CFE is recognized as one of the largest electric utilities in the world and still has integrated all the processes of electric service. For background to help us get a better view of the total housing the State of Mexico that have electricity service, INEGI statistics are taken, with the following results of general and particular.

- Entity: Mexico (15)
- Total population: 15 175 86
- Representing 13.5% of the national population.
- Population density (inhabitants / km<sup>2</sup>): 679.0
- Total municipalities: 125
- Municipalities with larger populations:
- Ecatepec de Morelos 1656107
- Nezahualcoyotl 1110565
- Naucalpan 833,779

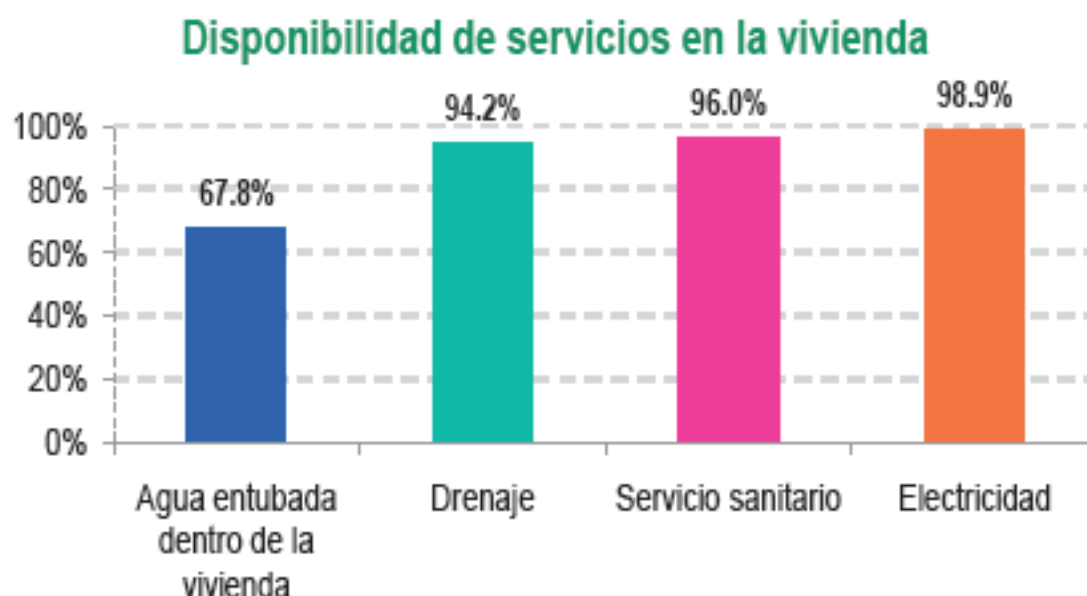
[5]



Fig.1 "Territory Edo.Mex". Source: inegi.org.ar

- Housing: Total private dwellings: 3749106
- Average number of occupants per dwelling \*: 4.1

This information throws us in the State of Mexico 41240 homes do not have electricity service, you are talking about that 169.084 people live without this service is generally speaking the State of Mexico for the territory.



. 2 "Grafica service of the State of Mexico". Source: inegi.org.ar

Municipalities that the percentage of total housing is greater than 2% and the necessary data have to propose expanding the mains using alternative energy being as follows were taken. (Table 1)

<ul style="list-style-type: none"> <li>- Acambay</li> </ul> <p>Total private dwellings: 14 207 5%</p> <p>Average number of occupants per dwelling *: 4.3</p>	<ul style="list-style-type: none"> <li>- Aculco</li> </ul> <p>Total private dwellings: 10,516, 6.9%</p> <p>Average number of occupants per dwelling *: 4.3</p>
<ul style="list-style-type: none"> <li>- Almoloya de Alquisiras</li> </ul> <p>Total private dwellings: 3622, 3.9%</p> <p>Average number of occupants per dwelling *: 4.1</p>	<ul style="list-style-type: none"> <li>- Almoloya de juarez</li> </ul> <p>Total private dwellings: 32,840, 3.6%</p> <p>Average number of occupants per dwelling *: 4.4</p>
<ul style="list-style-type: none"> <li>- Amanalco</li> </ul> <p>Total private dwellings: 5254, 7.3%</p> <p>Average number of occupants per dwelling *: 4.4</p>	<ul style="list-style-type: none"> <li>- Amatepec</li> </ul> <p>Total private dwellings: 6511, 3.1%</p> <p>Average number of occupants per dwelling *: 4.0</p>
<ul style="list-style-type: none"> <li>- Atlacomulco</li> </ul> <p>Total private dwellings: 21,168, 3%</p> <p>Average number of occupants per dwelling *: 4.4</p>	<ul style="list-style-type: none"> <li>- Chapa de Mota</li> </ul> <p>Total private dwellings: 6337, 3.9%</p> <p>Average number of occupants per dwelling *: 4.4</p>
<ul style="list-style-type: none"> <li>- Coatepec Harinas</li> </ul> <p>Total private dwellings: 8224, 2.8%</p> <p>Average number of occupants per dwelling *: 4.4</p>	<ul style="list-style-type: none"> <li>- Donato Guerra</li> </ul> <p>Total private dwellings: 6888, 9.8%</p> <p>Average number of occupants per dwelling *: 4.9</p>
<ul style="list-style-type: none"> <li>- El Oro</li> </ul>	<ul style="list-style-type: none"> <li>- Ixtapan del Oro</li> </ul>

Total private dwellings: 7599, 2.9%	Total private dwellings: 1531, 5.6%
Average number of occupants per dwelling *: 4.5	Average number of occupants per dwelling *: 4.3
- Ixtlahuaca Total private dwellings: 30 851 2.9%	- Jilotepec Total private dwellings: 19,975, 3.8%
Average number of occupants per dwelling *: 4.6	Average number of occupants per dwelling *: 4.2
- Jiquipilco Total private dwellings: 15,210, 3.6%	- Jocotitlán Total private dwellings: 14,570, 3.2%
Average number of occupants per dwelling *: 4.5	Average number of occupants per dwelling *: 4.2
- Luvianos Total private dwellings: 6104, 5.8%	- Morelos Total private dwellings: 6470, 7.3%
Average number of occupants per dwelling *: 4.6	Average number of occupants per dwelling *: 4.4
- Oztoloapan Total private dwellings: 1095, 2.6%	- Polotitlán Total private dwellings: 3256, 2.4%
Average number of occupants per dwelling *: 4.4	Average number of occupants per dwelling *: 4.0
- San Felipe del Progreso Total private dwellings: 23,971, 7.1%	- San José del Rincón Total private dwellings: 17,712, 6.5%
Average number of occupants per dwelling *: 5.1	Average number of occupants per dwelling *: 5.2
- San Simón de Guerrero Total private dwellings: 1457, 3.6%	- Soyaniquilpan Total private dwellings: 3007, 4.6%
Average number of occupants per dwelling *: 4.3	Average number of occupants per dwelling *: 3.9
- Sultepec Total private dwellings: 5698, 6%	- Tejupilco Total private dwellings: 16,121, 3.1%
Average number of occupants per dwelling *: 4.5	Average number of occupants per dwelling *: 4.4
- Temamatla Total private dwellings: 2772, 2.6%	- Temascalapa Total private dwellings: 8868, 2.8%
Average number of occupants per dwelling *: 4.1	Average number of occupants per dwelling *: 4.1
- Temascalcingo	- Temascaltepec

Total private dwellings: 14,392, 3.3% Average number of occupants per dwelling *: 4.4	Total private dwellings: 7444, 3.4% Average number of occupants per dwelling *: 4.4
- Temoaya Total private dwellings: 17,982, 2.4% Average number of occupants per dwelling *: 5.0	- Texcaltitlán Total private dwellings: 3835, 3.4% Average number of occupants per dwelling *: 4.5
- Timilpan Total private dwellings: 3859, 2.2% Average number of occupants per dwelling *: 4.0	- Valle de Bravo Total private dwellings: 14,838, 2.4% Average number of occupants per dwelling * 4.1
- Villa de Allende Total private dwellings: 10,013, 7.1% Average number of occupants per dwelling *: 4.8	- Villa del Carbon Total private dwellings: 10,270, 4.5% Average number of occupants per dwelling *: 4.4
- Villa Guerrero Total private dwellings: 13,884, 3% Average number of occupants per dwelling *: 4.3	- Villa Victoria Total private dwellings: 18,724, 7.2% Average number of occupants per dwelling *: 5.0
- Zacualpan Total private dwellings: 3479, 7.4% Average number of occupants per dwelling *: 4.3	- Zumpahuacán Total private dwellings: 3434, 6.9% Average number of occupants per dwelling *: 4.8

Table 1. "Municipalities with the highest number of homes without power"

The data collected on the table, the highlights are too many homes that do not have mains, another point that also takes is with the proposed implementation of these technologies would not just benefit these homes, but that nearby houses would no longer be supplied directly from the conventional network and demand for energy production would decrease, reaching the goal of reducing environmental pollution as well as provide better service quality of life for these families.

## 7.- Citizen participation

For citizen participation questionnaire to communities in three different municipalities integrated in the State of Mexico, which are Zacualpan, Ixtapan de la Sal and Toluca was held, questionnaires to which the results are the following took place:

In general the population has a very no information on this type of energy, operation and indeed serve as support for the declining production of conventional energy, mention that one of the problems for the implementation of alternative energy not only in the State of Mexico, but throughout the country, is a political conflict and private companies as it is CFE, as mentioned low consumption of its production by harming its economy.

Finally with the data collected shows that people are willing to invest in this type of energy to help care for the environment as well as having its own benefit, one of the problems detected are economic and political factors.

There is interest, a curiosity on the part of the population that is very positive in the expected response of the people, because the results say the total respondents would support with their time and resources available to them for this to come true, mention that it is a new way to get energy which will help them meet their daily needs and have a decent life being one of the main rights as agreed in our Constitution currently governed.

As would also be a factor for the development of the country in the field of infrastructure service, technological advances and not leaving behind one of the main objectives for which this project was carried out is decreasing generation of pollutants released into the atmosphere that damaging our planet, resulting in global warming.

## **8.- Applicable energy in regions of the state of Mexico**

To mention a specific place, in this case the State of Mexico is first necessary to know all about location, type of climate, prevailing winds, even with few rivers account in order to have the necessary data and propose the use of these energies.

The State of Mexico is located in central Mexico, in the eastern part of the table Anahuac. Bordered on the north by the states of Querétaro and Hidalgo; and south by Guerrero and Morelos; east with Puebla and Tlaxcala; and west by Guerrero and Michoacan, as well as the Federal District, which surrounds the north, east and west. [6]

Below is specifically described the main features of different technologies for the use of renewable energy in the State of Mexico.

### **8.1.- Solar energy**

This energy as already mentioned is obtained from solar rays or better known as solar radiation, this will be transformed through a field of photovoltaic cells that transform sunlight into electricity. This is an important point to be taken up in this energy source, as we know the sun is a renewable energy source even said to be inexhaustible, we have it in every corner of the planet.

For efficiency of these solar cells planted is necessary to open spaces, not having any obstacles that can generate shadow, addressing what the State of Mexico. (fig. 3)

Could observe that the less mountainous area is the northeastern part of the state as indicated on the map, comprised of a region with little rugged topography which is conducive to the seeded cells are generated



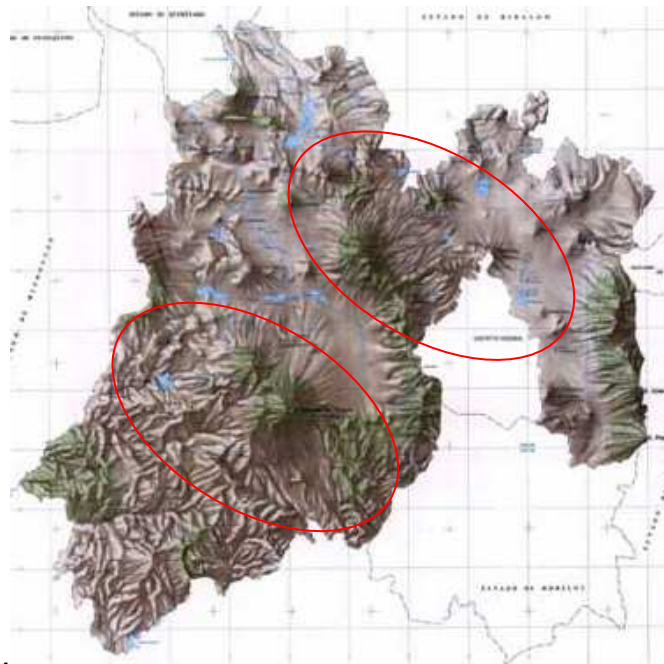


Fig 3. "Topography of State." Source: INEGI

- The most important advantage of all is that this energy does not pollute.
- When you're talking of solar energy we can say that is a powerhouse.
- It is an ideal system for harnessing energy to areas where the power line fails (rural, mountainous islands), or is difficult and costly to transfer.

## 8.2.- Wind energy

Wind turbines convert the kinetic energy of wind into mechanical energy, either to move directly to a machine such as a water pump, or to drive an electric generator. In the State of Mexico has several mountain ridges which at its height the wind is faster or because the calls are generated wind tunnels is when two mountains decrease reducing dispersion step that generates higher speed winds . The most important elevations in the State of Mexico. (fig. 4).

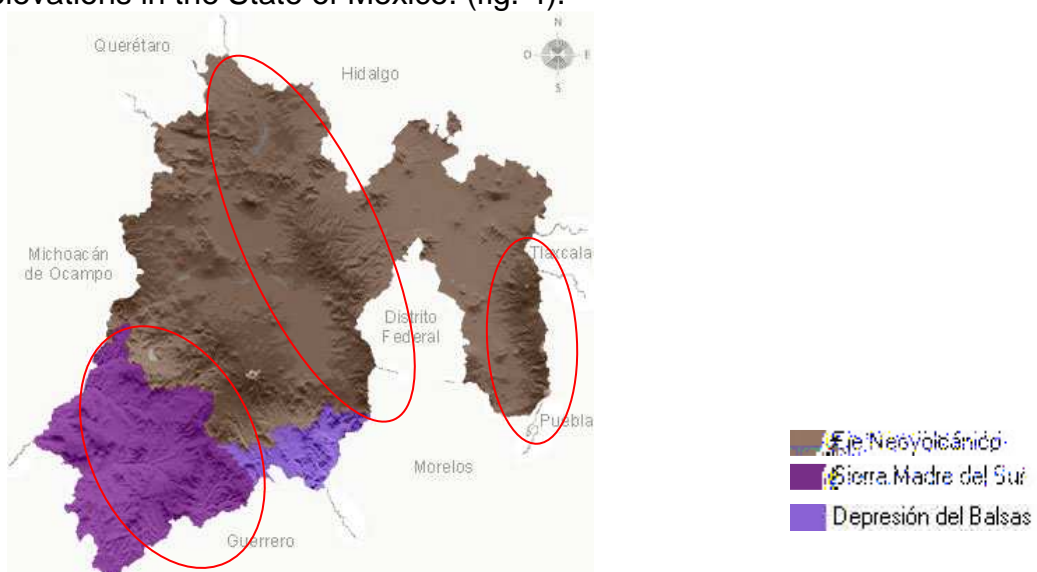


Fig. 4. "mountainous areas of the state." Source: INEGI

- It is a clean energy because it does not require a combustion produces carbon dioxide (CO<sub>2</sub>), and does not produce atmospheric emissions or polluting waste.
- Can be placed in areas unsuitable for other purposes, for example in desert areas near the coast, in arid hillsides and steep to be cultivated.
- Can coexist with other land uses, eg grassland for livestock use or low crops such as wheat, corn, potatoes, beets, etc.

### 8.3.- Thermal energy

Solar radiation is traditionally used for a variety of thermal applications such as heating and passive cooling of buildings, production of salt or drying clothes, grain, wood. The main technology for harnessing solar thermal radiation is the solar water heater. Solar heaters are mainly divided into two types: flat plate collectors and evacuated tubes. Early ones consist of a metal plate and receiving the radiation that is welded tubes through which water flows, all placed inside a box whose upper part is made of glass or some other transparent material. [7]

On this map you can see the different types of climates present in the State of Mexico, note that for the use of thermal energy is talking about smaller scale application in each room houses everywhere radiation is present and the points where it is present is the southwest and northeast of the State of Mexico. (Fig. 5). Efficiencies of solar heaters are typically 50%, although there are technologies with greater efficiencies.

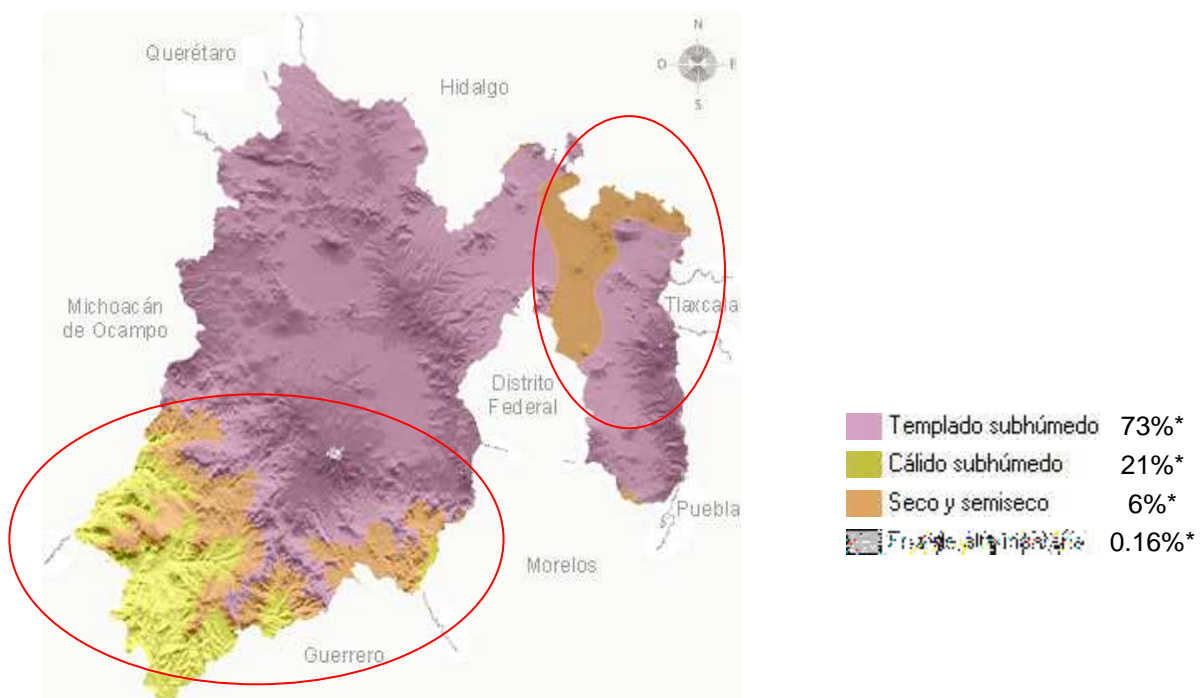


Fig. 5. "climates of the State". Source: INEGI.

### 8.4.- Hydraulic power

The most widely used technology today to harness the energy of moving water is the hydraulic turbine. There are different types of turbines; depending on the characteristics of each site (for example, sites with great fall and low flow or low head and large flow), the most suitable type is selected.

For the generation of hydropower water stream which creates mechanical energy which is then converted to electrical energy is needed, and checking the main rivers in the state of Mexico the results are as follows. (fig. 6)

#### Rivers

- |                 |                    |
|-----------------|--------------------|
| - Lerma         | - San Juan del Río |
| - San Felipe    | - San Bernardino   |
| - Temascaltepec | - Ixtapan          |
| - Sultepec      | - Meyuca           |
| - La Venta      | - Chalma           |

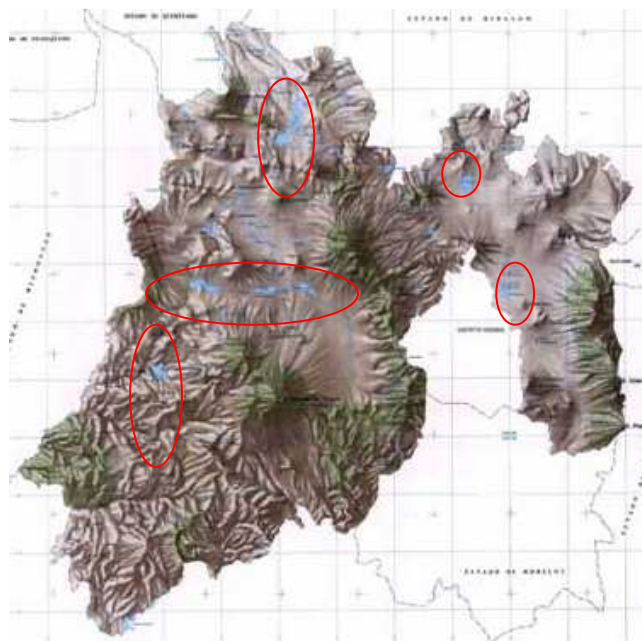


Fig. 6. "State Hydrography. Source: INEGI

- Due to the water cycle availability is inexhaustible.
- It is a totally clean energy, emit gases, produces no toxic emissions, and does not cause any kind of acid rain.
- It is cheap energy, operating costs are very low, there are constantly technological improvements that help more efficiently exploit resources.
- Allows for easy storage of water supply recreation or irrigation systems.

#### 9.- Environmental benefits

Mitigation of Climate Change in Mexico "the energy sector contributes 61% of emissions of greenhouse gases, and the country ranks 13th globally in terms of their greenhouse gas emissions." [8] The use of renewable energies, moving the consumption of fossil fuels, is one of the main strategies for mitigating climate change worldwide.

There are also organizations that provide the support for the implementation of such projects, which are private initiatives and government and are as follows:

- SENER
- National Science and Technology (SNCyT)
- Electrical Research Institute (IIE)
- Federal Electricity Commission (CFE)
- SEMARNAT

## 10.- Conclusions

Energy production is a vital element for development. But this is to occur under a number of principles, such as economic, environmental and social sustainability, so that before damage, benefiting human society and its development, which is the end of all application processes technologies. In the project, and with citizen participation shows that people are interested in learning more about this type of obtaining energy to meet their needs, and know that it is a good investment.

This project was conducted to provide an overview of how is electricity and households that do not have service, it is a guide to information on the different types of energy and raises the proposals to be made in different areas of study.

## 11.- Suggestions

In carrying out this project was achieved both collect scientific information and public participation for which and as mentioned conclusions and suggestions the following activities are proposed:

- Dissemination of information for people to know more about these energies.
- Workshops to publicize ways of using and maintenance needed for its proper functioning.
- Collaboration between government and citizens

This type of energy at present not look much but they are becoming a focus of study and implementation by countries and to improve the quality of life of its population and aiming at the reduction of pollution caused by generating conventional energy. As well as promoting research not only for the State of Mexico, but for any region of the world.

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